Neonatal resuscitation in Canadian hospitals

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A survey of Canadian hospitals providing obstetric care was undertaken to assess preparation, protocols, training and staff availability for neonatal resuscitation. Of the 721 hospitals contacted 577 (80%) responded. The reported availability of written guidelines for resuscitation varied greatly, depending on hospital size and proximity to a tertiary care centre. Many hospitals, especially those with 300 births or fewer annually, reported that they depend on family physicians or nurses to start and to continue neonatal resuscitation. Approximately one third of the hospitals had written guidelines for summoning personnel for additional help, and one third used a list of maternal or fetal indications for the presence of a physician specifically for the care of the infant at birth. Of 200 hospitals 138 (69%) had to summon additional medical help from outside the institution, 60% at all times. A neonatal resuscitation team in which members' roles were defined was established in 22% of the hospitals. Few hospitals held rehearsals for resuscitation. Nurses were permitted to perform intubation in 21 hospitals (4%), 7 of them in Alberta. National professional bodies should develop guidelines for training and skill maintenance, and hospitals should develop protocols for maintaining equipment and for neonatal resuscitation team activities, including regular practice. Training should be improved in family practice and obstetrics programs, and consideration should be given to training senior obstetric nurses and respiratory therapists in intubation of neonates.

Pour évaluer le degré de préparation, les protocoles, la formation et la disponibilité du personnel en matière de réanimation néonatale, on a tenu un sondage auprès des hôpitaux canadiens offrant des soins en obstétrique. Des 721 hôpitaux sollicités, 577 (80%) ont répondu. L'existence de lignes directrices écrites pour la réanimation variait grandement selon l'envergure de l'hôpital et la proximité d'un centre de soins tertiaires. De nombreux hôpitaux, particulièrement ceux où se produisent 300 naissances ou moins annuellement, ont indiqué qu'ils confient aux médecins de famille ou aux infirmières la tâche d'entreprendre et de poursuivre la réanimation néonatale. Environ un tiers des hôpitaux disposait de lignes directrices écrites pour obtenir l'aide supplémentaire de personnel appelé à cette fin, et un tiers employait une liste d'indications chez la mère ou le foetus justifiant la présence d'un médecin à l'accouchement. Sur 200 hôpitaux, 138 (69%) devaient obtenir de l'aide médicale supplémentaire de l'extérieur, et 60% en permanence. Dans 22% des hôpitaux, il y avait une équipe de réanimation néonatale dont le rôle des membres était défini. Peu d'hôpitaux procédaient à des simulations de réanimation. Dans 21 hôpitaux (4%), et 7 d'entre eux en Alberta, les infirmières étaient autorisées à intuber. Les organismes professionnels nationaux devraient élaborer des lignes directrices quant à la formation et au maintien des compétences, et les hôpitaux devraient établir des protocoles régissant le matériel et les activités des équipes de réanimation néonatale, y compris des exercices à intervalles réguliers. Il faudrait améliorer la formation dans les programmes de médecine familiale et d'obstétrique et envisager de former les infirmières d'expérience en obstétrique et les thérapeutes respiratoires à l'intubation des nouveau-nés.

Over 50% of all neonatal deaths recorded in the 1970 British Birth Survey occurred in infants who failed to breathe in the first 3 minutes.[1] Early death has been reported to occur in 5% to 10% of infants with an Apgar score of less than 4 at 1 minute.[2] Nelson and Ellenberg[3] reported that cerebral palsy developed in 1% of surviving term neonates with an Apgar score of less than 4 at 5 minutes and in 9% of those with a score of less than 4 at 15 minutes.

There are various views on the role of perinatal events in the development of cerebral palsy. A recent review suggested that at least 25% of cases are attributable to asphyxia at birth.[4] Data from the US National Collaborative Perinatal Project indicate that for infants born at term obstetric complications play a relatively minor role, but the risk is markedly increased for the relatively small group of term infants who experience obstetric complications and have low Apgar scores at 5 minutes.[5] Other reports are difficult to evaluate because of the well-recognized inconsistencies in recording

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Apgar scores. Furthermore, even when the scores are carefully recorded, they correlate poorly with biochemical markers of asphyxia.[6]

Despite the limited understanding of the role of intrapartum events in long-term handicap in childhood, it is generally acknowledged that persistence of presumed asphyxia, as gauged by a low Apgar score, may aggravate or even cause cerebral damage.[7] It therefore seems reasonable to assert that appropriate plans should be developed in institutions where infants are born to ensure that asphyxia is relieved as quickly as possible after birth.

Infants born to women with high-risk pregnancies, premature infants and infants who are small for their gestational age are the three groups most likely to require skilled resuscitation at birth.[8,9] Risk evaluation in community hospitals and appropriate referral before or during labour permits anticipation of the need for neonatal resuscitation in only 52% of infants who require it.[10] Ideally, personnel capable of resuscitation of the newborn should be available at all times in institutions where babies are born. However, it has been our experience that compared with the numbers of staff prepared for adult cardiopulmonary resuscitation, relatively few staff are prepared for emergency neonatal resuscitation.

A review of the literature showed that no national Canadian data had been collected on preparedness, training opportunities or availability of suitably trained personnel for resuscitation of newborns. We therefore undertook a national survey to assess these aspects of perinatal care in Canadian hospitals.

Methods

A four-page, 20-item questionnaire was developed to gather information on various aspects of resuscitation of the newborn, including the availability of written protocols, the personnel responsible for initial and for continuing resuscitation, the availability of these people, and the preparation and opportunities for continuing training and practice. In addition, suggestions for improving currently available services were sought. The questionnaire included Yes/No, multiple-choice and open-ended questions. Its acceptability and clarity were pretested in 12 hospitals whose size and location were representative of those of Canadian hospitals. The questionnaire was mailed with a covering letter in April 1985 to the directors of nursing of the 721 hospitals providing obstetric services identified from the 1984 *Canadian Hospital Directory*.[11] A second questionnaire was mailed to nonrespondents 1 month later.

Results

There were 577 responses out of a possible 721 (80%). A response rate greater than 70% was obtained from all but one province and the Northwest Territories. Of the hospitals 70 were teaching and 507 were nonteaching. Sixty-seven of the hospitals (12%) indicated that they had a neonatal intensive care unit (NICU), and 37 (6%) noted the availability of a neonatal transport team.

Written protocols for resuscitation

Written protocols were available for neonatal resuscitation in the delivery room in 55% of the hospitals, for training of personnel in 43% and for maintenance of resuscitation equipment in 59%. A larger proportion of the hospitals with more than 1000 births per year than of the smaller hospitals had protocols for neonatal resuscitation (65% v. 48%), for training of personnel (54% v. 38%) and for maintenance of equipment (58% v. 45%). Protocols were more frequently available in teaching than in nonteaching hospitals and in hospitals close to regional perinatal centres.

Personnel performing resuscitation

Initial resuscitation, defined in the questionnaire as stimulation, suction and administration of oxygen by mask or by bag and mask, was undertaken with equal frequency by the delivery room nurse alone (30%), the physician alone (33%), and the nurse and physician together (30%). The physician alone was much more likely to begin resuscitation in the smallest hospitals (100 births or fewer per year), and the nurse alone was somewhat more likely to begin resuscitation in the slightly larger hospitals (101 to 300 births per year) (Table I). In teaching hospitals other staff were more likely than a physician alone to begin resuscitation, but the nurse alone was responsible in 30% of these hospitals.

The family physician (in 77% of hospitals), the nurse (in 49%) and the anesthetist (in 42%) were most commonly either the first or second person responsible for continuing resuscitation, defined as endotracheal intubation for suctioning, intubation with assisted ventilation, and external cardiac massage. Pediatricians were next most commonly the first or second person responsible (in 18% of hospitals). Obstetricians were responsible in 7%. Family physicians were most commonly involved in smaller hospitals. Some interprovincial differences were noted and were perhaps related to variations in the proportion of small hospitals and to patterns of obstetric practice.[12]

Nurses were the first or second person responsible for continuing resuscitation in 35% of the nonteaching hospitals and 10% of the teaching hospitals. Nurses assumed responsibility for continuing resuscitation to a greater degree in Manitoba and Saskatchewan, and family physicians did so in British Columbia, Alberta, New Brunswick,

Nova Scotia and Newfoundland. Family physicians assumed responsibility to a lesser degree in Ontario and Quebec.

Maternal and fetal indications for neonatal care by a physician

A total of 167 hospitals (29%) had an agreed-on list of maternal indications for the presence of a physician specifically for the care of the neonate at birth, and 158 (27%) had a list of fetal indications. The largest hospitals (more than 1000 births annually), teaching hospitals and hospitals with NICUs were much more likely than smaller and nonteaching hospitals to have such lists. Hospitals close to regional perinatal centres were most likely to have such guidelines (Table II).

Availability of additional help

Of the respondents 212 (37%) stated that there were written guidelines for the additional help to be summoned for neonatal resuscitation; 54% of the teaching hospitals and 35% of the nonteaching hospitals had such guidelines. Larger hospitals were more likely than smaller hospitals to have such guidelines.

The person to be summoned when additional help was required was specified by 188 respondents: 30% called a pediatrician, 25% a neonatal transport team, 22% another family physician, 20% an anesthetist and 3% a nursing supervisor, a neonatologist or a respiratory technologist. An anesthetist or pediatrician was most commonly summoned in the larger hospitals (more than 300 births per year) and the teaching hospitals, whereas the neonatal transport team or another family doctor was most commonly summoned in the smaller hospitals.

Table III shows the location of the personnel summoned for additional help. Of the 138 hospitals having to summon personnel from outside the hospital 60% had to do it at all times. Most of the smaller hospitals and 50% of the hospitals with more than 1000 births per year had to summon help from outside. More of the nonteaching hospitals than of the teaching hospitals had to call on outside help (75% v. 40%).

Neonatal resuscitation team

A total of 128 (22%) of the respondents indicated that there were defined roles for members of the team likely to be involved in neonatal resuscitation. While the largest hospitals were more likely than the smaller hospitals to have a resuscitation team, 56% had no team. The most common members of the team were registered nurses, family doctors, anesthetists, pediatricians, respiratory technologists, delivery room nurses, NICU nurses and neonatologists.

Of the 128 hospitals with a resuscitation team 68% clearly delineated the duties of each team

Table I—Personnel responsible for initial neonatal resuscitation in the delivery room in 577 Canadian hospitals

	Size of hospital, no. of births/yr; no. (and %) of hospitals				
Personnel	≤ 50 (n = 157)*	51–100 (n = 81)	101–300 (n = 126)	301–1000 (n = 106)†	> 1000 (n = 107)
Delivery room nurse alone	30 (19)	22 (27)	45 (36)	36 (34)	35 (33)
Physician alone	77 (50)	42 (52)	31 (25)	25 (24)	17 (16)
Physician and nurse	45 (29)	16 (20)	48 (38)	34 (32)	31 (29)
Other combination	3 (2)	1 (1)	2 (2)	10 (10)	24 (22)

*Two of the 157 did not respond to this question.
†One of the 106 did not respond to this question.

Table II — Availability of written guidelines for neonatal resuscitation, by distance from regional perinatal centre*

	Distance, km; no. (and %) of hospitals		
Subject of available guidelines	≤ 20 (n = 45)	21–100 (n = 171)	> 100 (n = 230)
Personnel to be summoned	26 (58)	60 (35)	64 (28)
Contingency plan for emergency resuscitation	27 (60)	50 (29)	63 (27)
Indications for presence of physician			
Maternal	20 (44)	46 (27)	45 (20)
Fetal	20 (44)	38 (22)	41 (18)

*Not all respondents who answered this question indicated the distance of their hospital from the regional centre.

member. Team rehearsals were held weekly or monthly by 16%, annually by 23%, sporadically by 38% and not at all by 23%. Provision for recertification was more common for nurses than for physicians.

Emergency resuscitation

Of the hospitals 192 (33%) reported that they had a contingency plan for emergency neonatal resuscitation. A total of 67% of the largest hospitals had such a plan, compared with 27% of the hospitals with 300 or fewer births per year. Hospitals with NICUs and those close to regional perinatal centres were most likely to have a contingency plan.

Endotracheal intubation by personnel other than physicians

Nurses were permitted to perform intubation in newborns in 21 hospitals (4%), none of which reported a recertification program for this purpose; these were larger teaching hospitals, especially those with NICUs. Seven of the hospitals permitting nurses to intubate were in Alberta, and the other 14 were in six other provinces. Nineteen hospitals permitted respiratory technologists to intubate; 15 of them had a recertification program.

Suggestions for improvement

The respondents' suggestions for improving neonatal resuscitation services are summarized in Table IV. The most frequent suggestion (by 21% of the hospitals) was improved or advanced training for nurses. Hospitals of all sizes expressed a need for written guidelines. The larger hospitals and the teaching hospitals were most interested in having nurses trained for endotracheal intubation.

Discussion

The relatively high response rate regardless of hospital size in our survey suggests that staff of Canadian hospitals are concerned with resuscitation of newborns. The main concerns seem to be the availability of written guidelines and the organization, availability and training of personnel. Although these guarantee neither that resuscitation will be readily available nor that it will be skilfully carried out, the absence of such guidelines may indicate that planning for resuscitation is inadequate.

Prompt resuscitation of the newborn requires the ready availability of skilled personnel at all births, a requirement that is currently not well met. In a study of seven community hospitals in Ontario the mean ratios of family physicians, pediatricians and anesthetists to annual births were 1:25 (extremes 1:19 and 1:42), 1:400 (extremes 1:360 and 1:640) and 1:136 (extremes 1:88 and 1:260) respectively.[10] Thus, in practical terms pediatricians and anesthetists can attend selected births for the purpose of resuscitation only if given adequate warning.

In our survey family physicians and nurses were the personnel most frequently involved in both initial and continuing neonatal resuscitation, especially in the smaller nonteaching hospitals. Opportunities for family physician trainees to learn neonatal resuscitation are limited in university-based training programs. Most of these programs are based in obstetric units in large teaching hospitals, where there are relatively few infants at low risk who require resuscitation, where anesthetists and NICU resuscitation teams are often readily available, and where family physician trainees often must compete with other trainees for learning opportunities. It also seems appropriate for obstetrician trainees to learn neonatal resuscitation.

A family physician with a relatively large obstetric practice would probably be called on to resuscitate a newborn less than once a year. To increase opportunities for skill maintenance, a limited number of family physicians serving any one community could establish an on-call schedule for neonatal resuscitation. For family physicians to regularly attend births of infants likely to require resuscitation, fee schedules would have to be modified. Current schedules provide relatively lit-

Table III — Location and availability of personnel summoned for additional help by 200 hospitals*

Location	Size of hospital, no. of births/yr; no. (and %) of hospitals				
	≤ 50 (n = 46)	51–100 (n = 21)	101–300 (n = 40)	301–1000 (n = 34)	> 1000 (n = 59)
Delivery room, available immediately	3 (7)	0 (0)	2 (5)	1 (3)	8 (14)
Hospital					
Available immediately	2 (4)	2 (10)	7 (18)	10 (29)	18 (30)
Not available immediately	1 (2)	0 (0)	4 (10)	0 (0)	4 (7)
Office/home	40 (87)	19 (90)	27 (68)	23 (68)	29 (49)

*Of the 212 hospitals with written guidelines for summoning additional help 200 answered this question.

tle recompense for the time necessary to attend such births unless neonatal intubation and resuscitation are performed.

Of particular concern in our survey was the fact that although nurses were the first or second person most often responsible for continuing resuscitation in 45% of the hospitals, they were permitted to intubate in only 4%. Training nurses for neonatal intubation has not been encouraged in the past. Indeed, responses to a survey of provincial nursing associations that we conducted in 1984 indicated that with few exceptions (e.g., neonatal transport team nurses) intubation of infants was not a recognized nursing responsibility in any Canadian province (Marion Lamb, Canadian Nurses Association: personal communication, 1984). Yet in many larger nonteaching hospitals maintenance of expertise might be easier for one senior obstetric nurse on any given shift than for family physicians, since fewer personnel would be involved.

Organization of teams for neonatal resuscitation should ensure identification of those responsible for resuscitation, their training and their availability. Less than one quarter of all hospitals in our survey identified such teams.

The present situation in Canada — up to 30% of hospitals apparently depend on nurses to start and continue neonatal resuscitation, yet provincial nursing associations do not acknowledge performance of intubation in the delivery room as a nursing responsibility — is clearly inappropriate. Nurses involved in neonatal resuscitation must be suitably trained and their skills recognized, as recommended by the American Academy of Pediatrics[13] in 1979 and endorsed by the Canadian Paediatric Society's Fetus and Newborn Committee (of which G.W.C. was a member) in March 1980.

Recommendations

On the basis of our findings and the difficulties encountered in many hospitals in ensuring that the needs of the asphyxiated newborn are met, we, on behalf of the Canadian Institute of Child Health, make the following recommendations.

Table IV — Respondents' suggestions for improving neonatal resuscitation services

Suggestion	No. (and %) of hospitals
Improved/advanced training for nurses	119 (21)
Written guidelines for resuscitation	90 (16)
Training/certification of family physicians to intubate	62 (11)
More rehearsals/practice	52 (9)
Permission for nurses to intubate	51 (9)
Written guidelines for presence of physician for neonatal care	29 (5)
More in-service practice for staff	29 (5)
Team concept	24 (4)

- Written protocols should be developed and made available in the delivery room in all hospitals for neonatal resuscitation, use of drugs for emergencies, selection and maintenance of equipment, and training of personnel for neonatal resuscitation. The protocols should encourage the development and maintenance of necessary skills by all who attend births and of physician/nurse neonatal resuscitation teams.
- Hospital staffs should agree on and display lists of maternal and fetal conditions that indicate the need for additional personnel to be summoned to attend before the birth of an infant likely to require resuscitation.
- The training of family physicians, especially those planning to enter obstetric practice in smaller community hospitals, should include the use of suitable practice models[14,15] to acquire expertise in neonatal resuscitation.
- Regular practice of neonatal intubation by selected staff should be encouraged in all obstetric units through the use of suitable animal and commercial* intubation models.[14,15]
- The role and responsibilities of senior clinical nurses in neonatal resuscitation, including intubation, should be explored by hospital staffs and their provincial nursing and medical authorities. Respiratory therapists should be considered for similar training.

Implementing these recommendations will not be easy but may be facilitated by collaboration of national bodies, including the College of Family Physicians of Canada, the Canadian Paediatric Society, the Canadian Nurses Association and the Canadian Hospital Association. A specific protocol for individual hospital staff could be based on the guidelines for neonatal resuscitation recently published by the American Medical Association[16] and those previously circulated by the Canadian Institute of Child Health.[17] Most asphyxiated newborns who require ventilatory support respond adequately to manual ventilation correctly delivered with bag and mask. All staff working in delivery rooms should be taught and should practise this relatively simple, but often inadequately performed, procedure. Assistance in developing training programs and organizing resuscitation teams in community hospitals should be sought from regional tertiary care centres. This is best carried out through regular visits to community hospitals by the regional perinatal outreach education team based at the tertiary care centre.[18,19]

Finally, facilities and protocols for neonatal resuscitation receive but scant attention in current requirements for hospital accreditation. The Canadian Hospital Association should clarify requirements for hospitals in this regard.

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Laerdahl Infant Intubation Model no. 08-00-00 ($220). Available from Safety Supply Canada, 55 Midpark Cres., London, Ont. N6N 1A9.

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